schaden spiegel

losses and loss prevention

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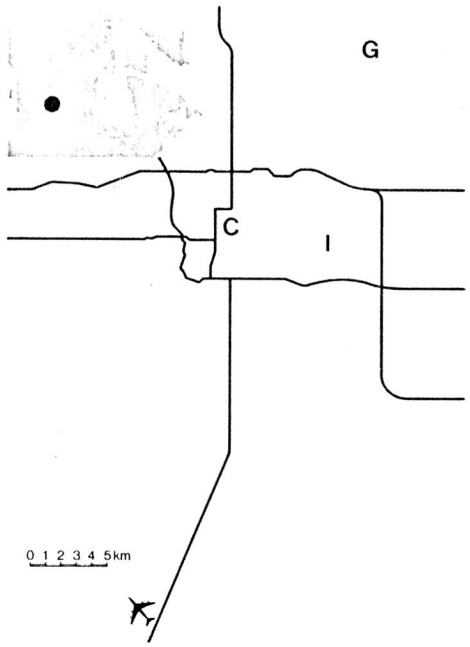
The disastrous storm that struck the city of Edmonton (530,000 inhabitants) in the West Canadian province of Alberta on the afternoon of 31st July 1987 killed 26 people, injured more than 250, and left almost 400 families homeless. The property damage amounted to hundreds of millions of Canadian dollars, about 300 million of which was covered by insurance, mostly fire and motor own damage.
Storm damage of a similar scale has occurred repeatedly in Canada during the last few years: a hailstorm in Calgary in 1981 (Can$ 100 million covered by insurance); a storm in Regina in 1983 (Can$ 50 million insured); a gale in 1984 and several tornadoes in 1985 in Southern Ontario (Can$ 65 and 117 million, respectively, insured); a hailstorm in Montreal in 1986 (Can$ 80 million insured); and another storm in Montreal



The funnel of the tornado first reached the ground near the international airport. Then it moved quickly northwards across the industrial area (I) east of the city centre (C) and on to the trailer camp "Glenview Park" (G), where it claimed the highest toll. The figures along its path indicate the intensity according to the five-stage Fujita tornado scale, the highest (3–4) corresponding to wind velocities of about 300 km/h.

● Edmonton



The tornado upset the car park of a transport company and destroyed several neighbouring storage sheds.

on 14th July 1987 (total damage exceeding Can$ 100 million). However, all these storm catastrophes are eclipsed by the extent of the loss caused by the 1984 Munich hailstorm, which cost about US$ 1,500 million, a bare 50 % of which was insured. (Cf our special publication "Hailstorm".) Edmonton, too, saw hailstones 5 cm in diameter on 31st July 1987 and the hail damage amounted to about US$ 50 million. However, more serious by far was the damage caused that day by a tremendous tornado, which left a trail of destruction, 30 km long and up to 500 m wide, across the eastern suburbs and industrial areas of Edmonton. It raged with particular fury in a camp of mobile homes: 200 of the 700 mobile homes stationed there were torn to pieces and it was here that the highest rate of casualties and injuries occurred.
The tornado had just before swept across an industrial zone. Although the production sheds, stores, office buildings, oil tanks, and truck yards were widely spaced over the area, enormous property damage resulted.
Above all, the light-construction indus-

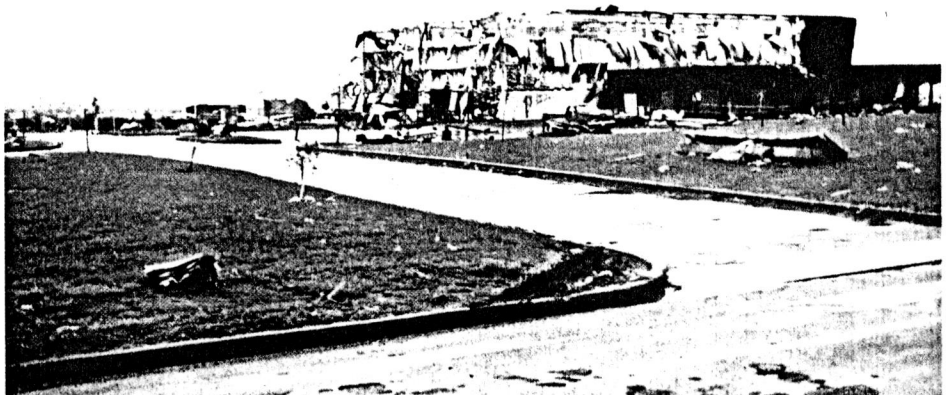
trial buildings with their large roof surfaces and curtain façades did not offer sufficient resistance to the strong wind forces and the impact of whirling debris. They were turned into total losses in a matter of seconds. The extent of the destruction exceeded even that caused by catastrophic earthquakes, because the ruins and re-usable remains were not left at the site but were literally "scattered to the four winds". Even a steel mill that was grazed by the tornado suffered millions of dollars' worth of damage: linings and roofs were torn off, load-



Strong gusts of wind that may have reached 300 km/h tore parts of the roof façade from this office building. Flying debris crashed through windows.

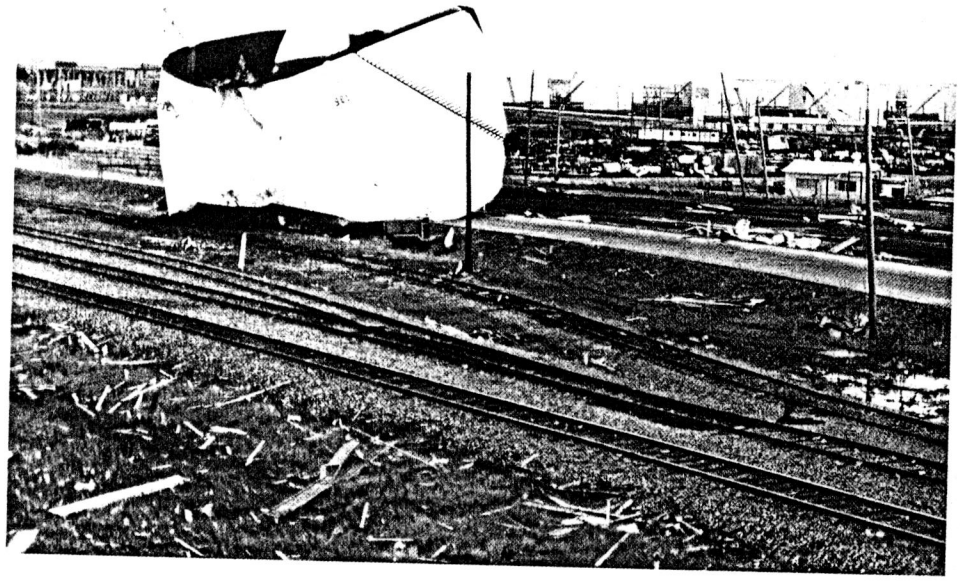


Some interior walls were all that was left of the production hall of a small metalworking factory. The path of destruction the tornado cut through the industrial area was about 500 m wide.



The tornado destroyed most of the facing of this storage shed and damaged the steel frame structure. Fortu-

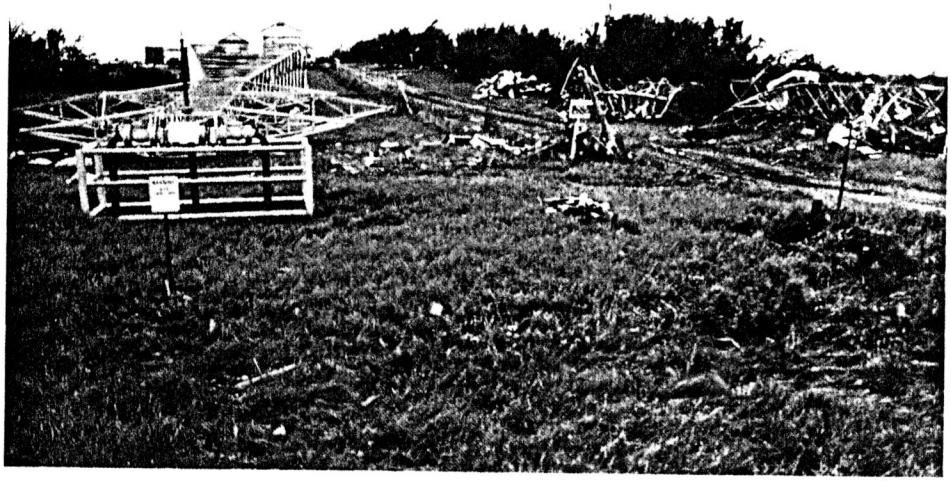
bearing steel frames twisted, and several storage sheds practically flattened to the ground. The enormous forces released by the tornado are impressively demonstrated by what happened to an oil tank, measuring about 15 m in diameter and 10 m in height, which was torn from its anchor bolts and pipe connections, lifted, and carried about 100 m through the air over the surrounding industrial plants before it landed, upside down, on a road just off a railway track.



This oil tank was lifted into the air and landed upside down on a busy industrial road about 100 m away. The large tank farm in the background was off the tornado's path.



Over a length of some 30 km, the tornado left scenes of destruction in its path like this storage shed (left) with a parking area and a line of previously green trees.



Demolition of a high-voltage mast carried out free of charge by the tornado (right). The new mast already delivered to the site (left) was only slightly affected.

Yet this Edmonton tornado was by no means one of exceptional force. From the type of damage wrought, its intensity has been inferred to be 3+ on the five-stage Fujita tornado intensity scale. This corresponds to a wind speed of 300 km/h, whereas the strongest tornadoes probably reach up to 500 km/h. As has been found by an evaluation of about 20,000 American tornadoes, only about 2 % of the total number are of force 4 or 5, while stage 3 tornadoes exceed 7 % and more than 90 % are weaker tornadoes. Regarding the damage caused, the breakdown is exactly the reverse: over 90 % of the damage is accounted for by the tornadoes of strength 3 and above.
As described in the article "Tornadoes", published in "schadenspiegel" 1981 No 2 pp 133–138, the climatic conditions in the Midwest of the United States encourage the formation of tornadoes. 800 tornadoes on average are observed in this area every year, while only between 50 and 100 are reported from the rest of the world. The total number of tornadoes, however, may actually be very much higher. In the province of Alberta alone, large parts of which are sparsely populated, the annual number of tornadoes reported has risen from only a few to more than 20 in recent years. With the huge dimensions of North American cities it can therefore no longer be considered an exceptional area of a city. However, a tornado "hitting a bull's eye", ie devastating a city centre, is rather improbable for physical reasons, because air streaming into the funnel of the tornado near the ground would probably be impeded in areas densely covered with high-rise buildings. Absolutely safe structural protection against tornadoes is impossible for the mere reason that objects and debris are hurled through the air like bullets; but it would also be economically unjustifiable because the probability of the event occurring is so low. Still, with the frequent occurrence of weak tornadoes, the storm-proof attachment of roofs and façades will greatly contribute to limiting the loss potential. In fully air-conditioned buildings special attention should be paid to dimensioning the windows in such a way that they will withstand the enormous pressure forces arising as a result of the sudden drop in pressure forces inside the funnel of a tornado. In addition, there should be solid shelters in each building where residents and employees can get to safety. Another important measure for the protection of life and limb is the further improvement of programmes for meteorological analyses and forecasting and of alarm systems using sirens and the media. Up to now, only the USA has developed all these protective measures to an acceptable standard.
and their surface area, the probability of tornado disasters will rise. An additional hazard begins to show for the not-too-distant future: the warming up of the earth's atmosphere by the "greenhouse effect" will speed up all vertical convection processes that serve to conduct the surplus energy from the surface of the earth into higher strata of the atmosphere. This development will also increase the frequency and intensity of natural hazards like thunderstoms, hail, torrential rain, tornadoes, and tropical storms, and this will be linked with a geographical expansion of exposed areas, and a lengthening of the seasons in which they might occur. This trend, if judged by the extraordinary natural disasters experienced in recent years, may have set in already. It is bound to put the insurance industry to ever more frequent and severer tests.
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